



Insulin Resistance

What is insulin?

The cells in your body can generate energy from all of the macronutrients: protein, fats, and carbohydrates. However, a vast majority of your energy is generated from fats and carbohydrates. Despite both being energy generating macronutrients, fats and carbohydrates are processed very differently in your body. When you consume carbohydrates, your body begins a chain reaction of events to break down the carbohydrates into glucose, a form of sugar. At any given time, you should only have a very small amount of glucose in your blood stream, approximately one teaspoon. When you get increased blood glucose levels from carbohydrate consumption your pancreas produces a hormone called insulin which drives the glucose out of your bloodstream and into the cells of your body where it can be used to generate energy. How responsive and efficient your body is at responding to the insulin signal is called insulin sensitivity.

All carbohydrates are eventually broken down into glucose. The speed with which your body is able to break them down is called the glycemic index. Here are examples of carbohydrates that get broken down into glucose:

- Sweet drinks: Gatorade, soda pop, creamer, juices...
- Desserts: ice cream, cookies, cakes, pies, candy...
- Simple carbs: white bread, pasta, crackers, cereals...
- Complex carbs: oats, brown rice, quinoa, squash...
- Fiber-rich: most fruits, vegetables, beans, legumes...

A vast majority of people don't need the amount of energy that they regularly consume in the form of carbohydrates. When you have more glucose in

your body than is needed for energy production the excess is converted into a molecule called glycogen which is stored in the skeletal muscle and liver primarily. You can think of glycogen as a fuel tank and glucose as the fuel. Your body never wants to waste energy, so when your glycogen fuel tank is full the "spillage" is converted into fat through a process called lipogenesis so that it can be used as fuel at some point in the future. Fat is the accumulation of excess energy consumed in the form of carbohydrates.

What is insulin resistance?

Carbohydrates are everywhere. Even most of the bacon you can buy at your local grocery will contain small amounts of carbohydrates. When you consume too many carbohydrates/sugars you end up with chronically elevated levels of insulin. In turn, your body adjusts to the higher insulin levels thus requiring your pancreas to produce even more insulin to achieve the same effect of driving the consumed carbohydrates/sugar into the cells. Over time, your body becomes resistant to all of the insulin your pancreas can produce naturally and your blood sugar begins to chronically elevate because the sugar can't be pushed into the cells. When this happens you have diabetes.

To be clear, carbohydrates are not bad. They are an excellent source of fuel for your body. It is the chronic consumption of too many carbohydrates, many of them with a high glycemic index, that causes the problem.



Insulin Resistance and Disease

When you're insulin resistant you require more insulin from your pancreas to push glucose into your cells. High levels of insulin may not CAUSE all chronic diseases, but at the very least it exacerbates them. In addition to diabetes, if you have insulin resistance you are at increased risk for:

- Heart Disease
- Stroke
- Metabolic syndrome
- Cancer
- Alzheimer's and neurodegenerative disease
- Inflammation
- Biological aging

Symptoms of Insulin Resistance

Some of the symptoms and signs you may experience if you have insulin resistance are:

- Sugar and carbohydrate cravings
- Hunger pangs
- Feeling the need to eat every 2-3 hours
- Moodiness
- Anxiety
- Trouble concentrating
- Skin tags
- A waist larger than 35" (women) or 40" (men)
- BMI > 30
- Fasting insulin > 8
- HOMA-IR score > 1.9

Strategies to Reverse Insulin Resistance

1. Eliminate Carbohydrates

You don't need carbohydrates to survive. As delicious and ubiquitous as they are, if you never ate another carbohydrate for the rest of your life you would probably live a longer and healthier life than the standard American diet you've been living with so far.

Optimal: The fastest and most aggressive way to improve your insulin sensitivity to completely remove carbohydrates from your diet. Doing a ketogenic diet and actually tracking your macronutrient count and using ketone urine strips or blood tests is a great way to do this. However, transitioning from a standard western diet to a ketogenic diet can be quite the adjustment and for some people just starting out may be a bridge too far.

Practical: The next best way to approach this strategy is to work on eliminating all high glycemic index carbohydrates. The faster and easier a food can be broken down into glucose the higher the glycemic index. Glucose has a glycemic index of 100.

- High GI: 70 - 100
- Medium GI: 56 - 69
- Low GI: 55 or less

For example, rice milk (processed with low fiber) has a GI of 92; whereas brown rice (unprocessed with high fiber) has a GI of 62. The glycemic index isn't a perfect metric. It doesn't account for how much of a food is being eaten, nutritional make up (how much protein, fat, minerals, vitamins, etc) it contains, or what it is being eaten with (i.e. apple vs apple w/ peanut butter). However, it remains a good starting



point for adjusting carbohydrate intake as you begin your journey towards better insulin sensitivity.

Using substitutions of lower glycemic foods instead of your usual high glycemic foods is a good way to reduce or eliminate higher glycemic foods from your diet.

High Glycemic	Substitution
White Potato	Sweet Potato
White Rice	Brown Rice
White Bread	Mixed Grain Bread
Cereals	Oats
Spaghetti	Spaghetti Squash
Soda	Sugar-free Soda

Pitfall: “Cheat meals” and snacks are a great way to destroy progress. Having one dedicated “cheat meal” a week is one thing. However, if you aren’t making progress what you’ll probably find is that it isn’t just pizza night or date night that is the issue. It’s the alcohol consumption after work once or twice a week, donuts at the office one morning, a quick sub with some chips during lunch one day, and a smattering of cheap snacks for an afternoon “energy” boost. The best way to counter cheat meal and snack creep is to keep track of your food consumption. There are many different apps that make this easy to do.

2. Intermittent Fasting

Fasting as a form of intentional dietary restriction has probably been around as long as humans and is practiced by every major religion. You fast every day whether you realize you are doing it or not. At some point every day you have your last bite of food and go to bed. Sometime after you wake up the next morning you eat breakfast which is literally breaking your fast from overnight. Fasting has a plethora of

positive effects and should be a regular part in everyone’s life to differing degrees. Specifically, regarding insulin resistance though, when you extend your time in between your last meal and your first meal you give your body more time with low glucose levels and subsequently allow your cells to re-sensitize to the correspondingly lower insulin levels.

Optimal: There are many different ways to incorporate fasting into your life; 5 days:2 days, 16:8, OMAD, alternate day fasting, time-restricted fasting, etc. One of the simplest ways to start is usually to extend your overnight fast by not having any late-night snacks and delaying the time before you consume calories in the morning. For example, eat dinner at 6pm and don’t have any snacks afterward. In the morning when you wake up consume only water, black coffee, or tea . Make sure you don’t put any caloric additives into your drinks such as creamer, milk, or sugar. If you can wait until 10am to eat your first meal, then you have just fasted for 16 hours!

Practical: Fasting is as simple as not eating but can definitely seem daunting if you’ve never really considered it. Fasting has benefits well beyond improving insulin sensitivity but if all you are focused on in reversing your insulin resistance then you can make some more minor modifications to your eating schedule that can provide some of the same benefits. At its core, intermittent fasting limits the amount of insulin spikes throughout the day. You can mimic this by eliminating snacks in-between meals so that you only get insulin spikes three times a day (breakfast, lunch, and dinner). One step better would be to have a breakfast that doesn’t include any carbohydrates (e.g. bacon and eggs). You will be able to eat breakfast at the time your body is used to getting calories, but you will increase the overall time between insulin spikes, dinner to lunch vs dinner to breakfast.



Pitfall: Dietary quality and total caloric intake still matter. If you extend your overnight fast to 16 hours but prep for it by gorging yourself at night and then having a huge carbohydrate rich breakfast, you may actually make things worse. Fasting works best if you combine it with improvements in your overall dietary quality (whole foods, reducing processed foods, reducing high glycemic index foods, etc.) and maintain or reduce the total number of calories you consume in a given 24 hours period.

3. Get Sleep

Studies show that both acute and chronic sleep deprivation raise glucose levels and worsen insulin resistance. It's unclear how much sleep is too little, too much, or just right. We don't know if there is a certain amount of lost sleep comparative to your ideal amount or a particular frequency of bad nights that triggers insulin resistance. However, we do know that sleep quality and quantity effect glucose and insulin levels.

Optimal: Make sure you dedicate at least an 8-hour period for uninterrupted sleep. Be consistent. Go to bed at the same time every night, including weekends. Make sure your bedroom is dark, quiet, and relaxing. Remove electronic devices such as TVs, computers, and smartphones from the bedroom. Stop use of electronic devices at least 30-minutes before bedtime. Avoid large meals, caffeine, and alcohol before bed.

Practical: Work schedules, family, and life in general can make getting a solid 8 hours of sleep a challenge. Focus on making sleep a priority and being consistent in your evening routine. Try to go to bed and wake up at the same time every day. Sneak in a nap to regain energy during the day, but don't go overboard since it can through off your sleep at night. Reduce or

eliminate alcohol consumption, particularly late at night and cut down on caffeine in the afternoon and evening. Use ear plugs and eye masks to drown out noise and light.

Pitfall: Obstructive sleep apnea is a very common cause of chronic sleep deprivation. Men who are overweight, over 50, and have a neck circumference > 16 inches are particularly high risk. If you snore, have had partner witness episodes where you stop breathing during sleep, have high blood pressure, and find yourself tired throughout the day talk to your health care provider about getting a sleep study to assess for obstructive sleep apnea.

4. Reduce Stress

Studies demonstrate temporary insulin resistance during periods of acute physiological and psychological stress such as a sudden illness or threat. This type of insulin resistance reverses as soon as the stress is over and have no long-term negative consequences. The more insidious problem of modern life is chronic stress. Little sleep, poor nutrition, stress over work/bills/family, lack of exercise, etc. all play a role in chronic activation of your body's fight or flight which also contributes to insulin resistance.

Optimal: Develop hobbies and routines that help to reduce chronic stress. Physical exercise, meditation, yoga, and being out in nature are all effective ways to reduce stress and increase general well-being and physical health.

Practical: Exercise is one of the best ways to reduce chronic stress, but if you hate to exercise then the thought of even going to the gym may cause more stress and anxiety. Experiment and find what works for you. Maybe going for an after dinner walk and



taking time to power down and read a book at night is all you need.

Pitfall: Doing too much. If you always say yes, you will quickly find that there is no time to take care of yourself. Work on establishing boundaries that give you enough time every day, week, month to work on doing the things that provide you relief from the chronic stress of the modern world.

5. Exercise

Exercise is arguably the most important thing you can do for your health; from weight control to reduction of chronic disease and cancer to delaying frailty and aging and everything in between. Exercise increases insulin sensitivity both short-term and long-term. Short-term improvements in insulin sensitivity occur during a workout and last through the immediate recovery stages which may last several hours. Long-term benefits of increased insulin sensitivity are likely from body composition changes and fat loss that frequently accompanies introduction of exercise programs. Fat loss in general helps insulin sensitivity, but fat loss alone can be accomplished through dietary changes. Exercise helps with fat loss, but also increasing skeletal muscle. Skeletal muscle is the greatest glucose sink you have. The more skeletal muscle you have the more room you have to store glucose, moving it quickly out of your circulation. In addition, exercise increases mitochondrial oxidative capacity which increases your cell's ability to burn through the glucose you consume so it doesn't "back up" in the system leading to chronically elevated glucose levels in the blood which stimulate the constant production of insulin.

Optimal: Exercise most days of the week; shoot for at least five out of seven days. Incorporate both strength training for muscle growth as well as high

intensity interval training to quickly deplete glycogen stores. Focus on free weights or machines to increase resistance and total workload (weight x repetitions) over time in order to stimulate muscle growth which will allow your body to handle larger carbohydrate loads.

Practical: Life is busy, and it can be difficult to find enough hours in the day for exercise. Just like sleep though, it is important to prioritize some amount of time for exercise into your routine. Dedicate at least 30 minutes a day. If going to a gym is too intimidating, time consuming, or financially burdensome then build a small space in your home. There are a number of different programs that can be viewed on your television or tablet that allow you to exercise in your living room. Make a concerted effort to start moving your body more. Park further away from stores, use stairs instead of elevators, stand and take a quick stroll around the office once an hour, go for a walk at night after dinner. As you begin to make small progress you can build up your routine over time. Don't do things that are miserable. If you love to run, then run. If you hate it don't. The most important part of any exercise routine is consistency. Getting 10,000 steps a day at work and after dinner walks for 5 years will change your life. A 30-day trial gym membership won't make a difference in your life at all.

Pitfall: Know your body. You may have been able to lift monster weights, run 19-minute 5k, or 3.5 hr marathon when you were 20, but that doesn't mean you should be attempting those feats at 40. As you age your body changes. It takes longer to recover and you are more likely to injure yourself in a way that prevents you from exercising for extended periods of time. For example, if you enjoy lifting weights stay away from 1-3 rep max weights and focus on getting to muscle exhaustion with 20 rep sets. If you enjoy



running focus on short to mid-range distances with good form and incorporate lower impact training with an elliptical or bicycle to allow for extended active recovery.

Moving Forward

Insulin resistance doesn't develop suddenly. It has taken years of diet and lifestyle choices to get to this point. You can't completely reverse years of choices overnight. However, by combining these five proven strategies you will be able to reverse your insulin resistance over time and live a longer and healthier life as a result.

Good Luck and Good health!